

AMENDMENTS IN THE SPECIFICATION:

In the Specification:

Please replace the paragraph beginning at page 9, line 13, with the following rewritten paragraph:

AI Referring now to Fig. 4, a block diagram of the imaging device 105 is shown. The imaging device 105 may be a scanning electron microscope (SEM) such as SEM commercially available from KLA-Tencor ~~TENCOR~~, San Jose, CA. The imaging device 105 includes a processor 200 for carrying out the operations described herein. The processor 200 may, for example be an ~~Advanced Micro Devices~~ ADVANCED MICRO DEVICES (AMD) ~~Athlon~~ ATHLON processor, an ~~Intel~~ INTEL ~~Pentium~~ PENTIUM III processor, or other suitable processor. Coupled to the processor 200 is a memory 205. As discussed in more detail below, in addition to standard operating code and other data, the memory 205 may have stored therein an image analysis program which serves to transform image data obtained from the imaging device 105 to a format suitable for use by the simulator 115. A disk drive 208 is also shown to be coupled to the processor 200 and serves in a conventional manner for retrieving and storing information from/to the disk 130 (Fig. 3). It will be appreciated that other suitable imaging devices, for example an atomic force microscope (AFM) or an optical microscope, may alternatively be used.

Please replace the paragraph beginning at page 10, line 13, with the following rewritten paragraph:

AD Referring now to Fig. 5, a block diagram is depicted of hardware components associated with the simulator 115. The simulator 115 includes a processor 235 for ~~performing~~ performing and carrying out various of the functions described herein. The processor 235 may, for example, be an ~~Advanced Micro Devices~~ ADVANCED MICRO DEVICES (AMD) ~~Athlon~~ ATHLON processor, an ~~Intel~~ INTEL ~~Pentium~~ PENTIUM III processor, or other suitable processor. Coupled to the processor 235 is a memory 238. The memory

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238 serves to store design files, data from the imaging device 105, software for carrying out the functions, such as the wafer fabrication simulation described herein, and other operating software and data. A disk drive 240 is also shown to be coupled to the processor 235 and serves in a conventional manner for retrieving and storing information to and from the disk 130 (Fig. 3).

Please replace the paragraph beginning at page 11, line 1, with the following rewritten paragraph:

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Turning now to Fig. 6, a block diagram of hardware components associated with the viewing station 110 is depicted. The viewing station 110 includes a processor 250 for performing and carrying out the various functions described herein. The processor 250 may, for example, be an ~~Advanced Micro Devices~~ ADVANCED MICRO DEVICES (AMD) ~~Athlon~~ ATHLON processor, an ~~Intel~~ INTEL ~~Pentium~~ PENTIUM III processor, or other suitable processor. Coupled to the processor 250 is a memory 255. The memory 255 serves to store CAD drawing files 257, design viewer software 259 and other operating software and data. A disk drive 260 is also shown to be coupled to the processor 250 and serves in a conventional manner for retrieving and storing information to and from the disk 130 (Fig. 3).

Please replace the paragraph beginning at page 13, line 7, with the following rewritten paragraph:

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More particularly, in order to convert the image data 300 to a format compatible with the simulator 115, an image analysis algorithm may be applied to the image data 300. The image analysis algorithm may be stored in the memory 205 of the imaging device 105; however, it will be appreciated that the image analysis algorithm alternatively may be stored and applied to the image data 300 at other locations. As shown in Fig. 7, the image analysis algorithm serves to detect various edges of the image data 300 and convert the image data into transformed image

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data 350 (hereinafter referred to as transformed data 350). For example, in the present embodiment, the image analysis algorithm is configured to detect the outer edge 335 of each of the structures 305, 310 to obtain transformed structures 352 and 354. It will be appreciated, however that the image analysis algorithm could alternatively be configured to detect the top surface edges 325 and/or other features depending on the application at hand. The image analysis algorithm may also binarize the image containing the transformed structures, providing an indication that the areas inside the contours should be clear, opaque, or phase shifting. Further, it will be appreciated that when imaging a mask having both a chrome and quartz region, the image analysis algorithm may be configured to display the quartz region as a semi-transparent colored overlay (e.g. a red overlay) so that a user can easily distinguish between the regions. The binarized image may be suitably scaled. Image analysis algorithms which are suitable for use with the present invention include the ~~Aphelion~~ APHELION image analysis software formerly available from Amerinex, of Amherst, Massachusetts.

Please replace the paragraph beginning at page 14, line 1, with the following rewritten paragraph:.

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Once converted, the transformed data 350 is stored in a file format which is compatible with the simulator 115. For example, the file format in which the transformed image data may be stored includes a ".tif", ".jpg", ".bmp", ".bit", ".gif", GDS, Mebes, etc. type file. The format in which the transformed data 350 is stored may, or may not, be in the same format as the design data so long as both formats are compatible for use with the simulator 115. Following such conversion, the transformed data 350 is transferred to the simulator 115. As discussed above, the transformed data 350 may be transferred via the network connection 125, via disk 130 or by other conventional means. It will be appreciated that while the present embodiment depicts transforming the image data 300 at the imaging device 105, it is possible for the image data 305 300 to be transformed at various other locations including at the simulator 115.

Please replace the paragraph beginning at page 14, line 20, with the following rewritten paragraph:

ALP The simulator 115 further transforms the transformed data 350 to simulate the wafer structure produced by the wafer fabrication process such as a lithography process. For example, an aerial transformation may be performed on the transformed data 350 to take into account anticipated variations which are caused by lens aberrations. Aerial transformation refers to a process by transformed data 350 is modified in advance to account for expected CD variations which will occur due to known lens aberrations or other factors. The expected CD variations are obtainable through known simulation programs such as Solid-C, produced by ~~Sigma-C~~ SIGMA-C of Munich, Germany and therefore further details regarding the manner in which such CD variations are obtained is omitted for sake of brevity. It will be appreciated that the CD variations expected due to the lithography process are dependent upon the details of that process, for example the type of resist, the wavelength of light used to expose the resist, the light intensity and exposure time, and the numerical aperture of the optics utilized.

Please replace the paragraph beginning at page 15, line 12, with the following rewritten paragraph

AN It will be appreciated that the transformation of the image of the mask 107 to a simulated wafer structure to be expected from wafer fabrication (lithography) processes utilizing the mask alternatively may be obtained by other means. Examples of such other means are the ~~Virtual Stepper System~~ VIRTUAL STEPPER SYSTEM software available from ~~Numerical Technologies, Inc.~~ NUMERICAL TECHNOLOGIES, INC., of San Jose, California, and the Aerial Image Measurement System (AIMS) available from Carl Zeiss, Inc.

Please replace the paragraph beginning at page 15, line 19, with the following rewritten paragraph:

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The ~~Virtual Stepper System~~ VIRTUAL STEPPER SYSTEM takes a an image of a mask with an optical microscope or the like for use directly as an input for a simulation program ~~whie~~ which emulates the optical system used to transfer the mask pattern to a wafer image. The optical parameters of the projection system used in model generation may include wavelength, numerical aperture, coherent factor (sigma), mask to wafer reduction factor, illumination mode, and defocus values.

Please replace the paragraph beginning at page 17, line 17, with the following rewritten paragraph:

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Once aligned, it is possible directly to compare the simulated wafer structures 350' and 350" with one another. For example, as shown in Fig. 9, it is possible to quickly and accurately determine the amount of rounding, line width variations, and other CD variations which have occurred to the structural elements 305', 310' 305, 310 by directly comparing such images to the overlaid structural elements 352", 354", respectively. Further, the present embodiment allows the operator to initiate automatic computations of CD variations via selected menu driven options

Please replace the paragraph beginning at page 18, line 18, with the following rewritten paragraph:

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Upon selecting the percentage area menu option 402 ~~404~~, the processor 250 of the viewing station 110 provides the operator with an opportunity to select the desired structure on the monitor 270 for which analysis is desired. For example, the operator may opt to select the structural element 352'. The operator may select the structural element 352' by positioning the mouse pointer 415 on the structural element 352' and/or on the overlaid structural element 352" and clicking on the mouse. Alternatively, the present embodiment of the invention allows an operator to select different structures by pressing a tab key or arrow keys on a keyboard. Of

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CDN- course, various other means for selecting the desired structure could also be used. Once selected, the processor 250 compares the transformed structure 352' with the corresponding structure 352" to compute a percentage difference in overall area occupied by the structural element 352'. The resulting percentage difference calculation is output to the operator in the result field 420.

Please replace the paragraph beginning at page 19, line 1, with the following rewritten paragraph:

A11 Upon selecting the perimeter measurement option 404, the processor 250 of the viewing station 110 provides the operator with an opportunity to select the desired transformed structure to be analyzed. The manner in which the desired transformed structure may be selected is similar to that described above with respect to selecting a structure for the percentage area calculation. Once selected, the processor 250 is programmed to calculate a line integral comparing a perimeter of the structural element 350' 352' with a perimeter of the corresponding structure 352" to compute a CD variation in accordance with conventional techniques known in the art. The result of the computation is output to the operator in the result field 420.

Please replace the paragraph beginning at page 20, line 12, with the following rewritten paragraph:

A10 In addition to the CD analysis menu options, the present embodiment also provides several additional features for controlling and manipulating the overlaid images. For example, continuing to refer to Fig. 11 9, additional menu options which are provided to the operator include, for example, an overlay toggle key 430, a manual realignment key 432, a zoom key 434, a scroll screen key 436, and a return key 438.
